

# **WVU Cooperative Agreement**

## **Decontamination Systems Information & Research Program**

### **DEPLOYMENT SUPPORT LEADING TO IMPLEMENTATION**

---

---

Dr. Echol E. Cook (ecook@cemr.wvu.edu; 304-293-3031 Ext. 658)  
Director, WVU Cooperative Agreement  
Department of Civil and Environmental Engineering  
P.O. Box 6103  
Morgantown, WV 26506-6103

---

## **Introduction**

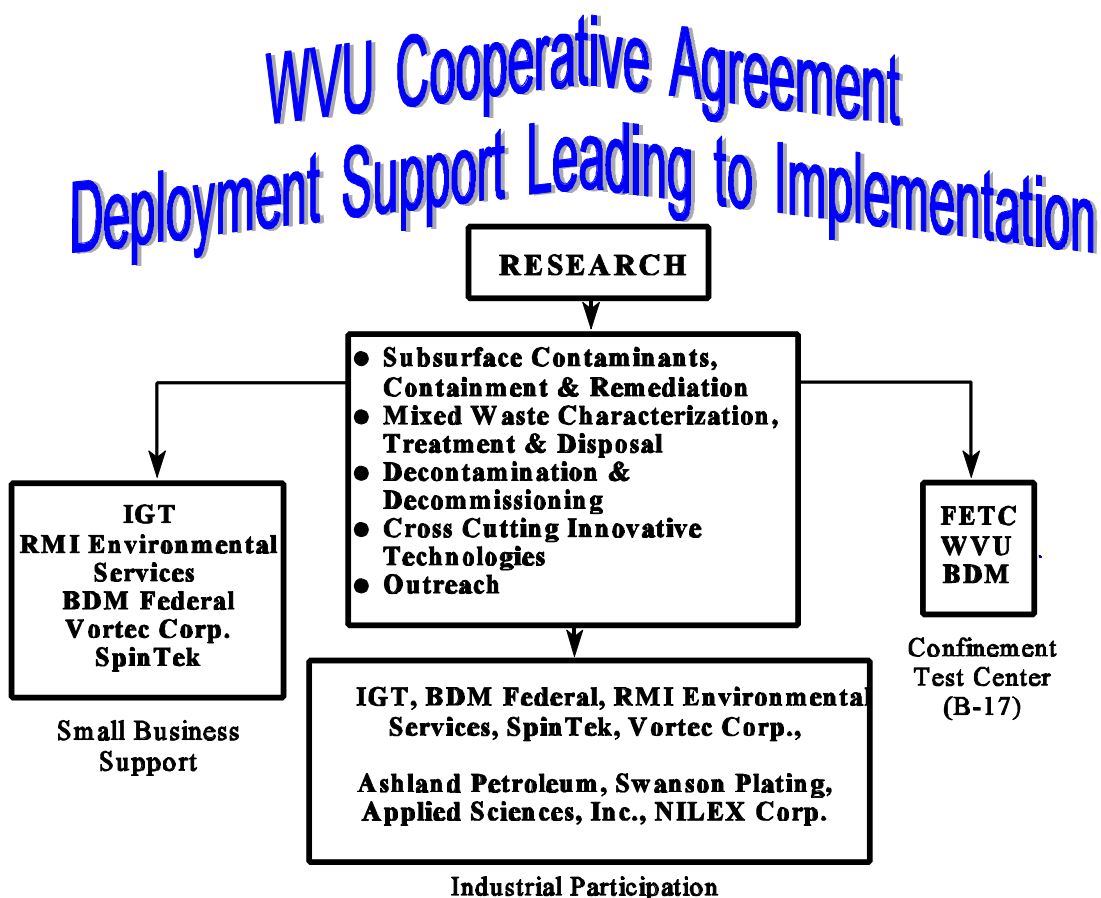
The Decontamination Systems Information and Research Program at West Virginia University is a Cooperative Agreement that focuses on research and development associated with hazardous waste remediation problems existing at Department of Energy, Corps of Engineers, and private sector sites. The Agreement builds on a unique combination of resources coupling university researchers with DOE sponsored small businesses, leading toward field tests and large scale technology demonstrations of environmental technologies. Most of the Agreement's projects are categorized in the Technology Maturity Levels under Gates 3 - Advanced Development, Gate 4 - Engineering Development, and Gate 5 - Demonstration.

## **Objectives**

- Couple WVU researchers with DOE funded small businesses to solve problems and remove barriers to commercialization of remediation processes.
- Identify and initiate development and demonstration of workable systems to fill gaps in current technologies bringing research to the Gate 5 - Demonstration level.
- Train and prepare students to enter industrial and agency positions in waste and site remediation professions.

## Approach

The Cooperative Agreement organizational structure is shown schematically in Figure #1. The Program is divided into the areas of Research, Industrial Participation and Small Business Support. The research is divided into the following WVU Focus Areas: 1) Subsurface Contaminants, Containment and Remediation, 2) Mixed Waste Characterization, Treatment and Disposal, 3) Decontamination and Decommissioning, 4) Cross Cutting Innovative Technologies and 5) Outreach. The Confinement Test Center is a unique collaboration between WVU, BDM Federal, Inc., and the DOE/FETC facility providing a test center for *in situ* barrier innovations. The Outreach Program provides opportunities for university researchers to team with the small businesses supported by DOE/FETC. This program is directly designed to address problems with innovative site remediation technologies, and assist in removing the barriers to commercialization of these processes.



**Figure 1: Organizational Structure**

## 1997 Projects

The research program includes a diversity of projects bringing together a cadre of investigators. Projects funded in 1997 are listed below under their respective WVU focus area:

### Focus Area 1.0: Subsurface Contaminants, Containment and Remediation

Drain Enhanced Soil Flushing (DESF) using Prefabricated Vertical Drains (PVDs) - Dr. M.A. Gabr, WVU: DESF provides enhanced *in situ* soil flushing using PVDs for remediation of contaminated sites where fine-grain soils are present. The research builds on the soil flushing process where remediation of contaminated aquifers using conventional pump-and-treat systems has shown to be ineffective and costly. The technology is being developed with **NILEX Corporation** and uses off the shelf equipment and supplies. Field demonstrations are ongoing at an **Ashland Petroleum Corporation** gas station site in Weston, WV. Pilot scale testing at this site has already been proven successful. The technology is also being demonstrated at the RMI facility in Ashtabula, Ohio.

Development of Standard Test Protocols and Barrier Design Models for Desiccation Barriers - Dr. K. Aminian & Dr. S. Ameri, WVU: The DOE/FETC B-17 building is being used to test the viability of *in situ* barriers for containing subsurface contaminants, such as those found under tanks at DOE's Hanford and Savannah River sites. A circulating air barrier that uses dry air injection to create a dry zone has been developed by BDM Federal, Inc. Drying a soil layer increases its liquid storage capacity and so the soil will tend to retain rather than transmit the liquids. The technology uses commercially available oil and gas technologies and equipment. The WVU Petroleum Engineering Department is providing technical support.

Laboratory Studies and Field Testing at the DOE/RMI Extrusion Plant, Ashtabula, Ohio - Dr. J. Quaranta, WVU: RMI was involved with the production of nuclear fuel elements for defense production reactors. Extrusion operations ceased in 1990 and the Nuclear Regulatory Commission has required the facility to implement accelerated site clean up. WVU is supporting RMI's clean up challenges by focusing on the remediation of low hydraulic conductive clay soil contaminated with TCE. A groundwater model is underway for predicting the extent of subsurface contaminant migration and chemical treatability studies are being reviewed for *in situ* remediation of TCE contaminated soil and groundwater. WVU, DOE-Ashtabula, and RMI are working together in problem identification and with bringing WVU's technical resources in technology development to bear on this decontamination and decommissioning project.

Pilot Scale Demonstration of Trichloroethylene (TCE) Flushing Using Prefabricated Vertical Drains (PVDs) at RMI, Ashtabula Site - Dr. M. A. Gabr, WVU: Phase I of this work includes proving the DESF technology at the pilot scale level at the RMI site where TCE contamination has been identified in the soil and groundwater. A small test pad consisting of eight PVDs will be constructed and the major parameters affecting the efficiency of the system will be studied. Water will first be injected, extracted and analyzed for TCE concentration changes with time and the number of pore volumes of extracted fluid. Surfactant flooding through the PVDs will follow, along with studies on the potential for surfactant recycling.

Technical Support for Surfactant Flushing Through PVDs at RMI, Ashtabula Site - Dr. J. Kilbane, Institute of Gas Technology (IGT): TCE is a highly recalcitrant environmental contaminant with low aqueous solubility and a density greater than water. It tends to sink and dissolve slowly serving as a source of groundwater contamination for decades. The goals of this work are to provide support services for the PVD field tests being conducted at the RMI, Ashtabula site. This includes selecting the appropriate surfactants, supplying the surfactants, and supplying nutrient solutions for enhancing natural *in situ* biodegradation of residual contaminants. Surfactant flooding evaluation considers the interfacial tension and phase behavior between surfactant solution and TCE. The ability to mobilize TCE, as indicated by interfacial tension measurements, will be the chief criterion.

Treatment of Soil Flushing Solutions Produced During Demonstration of the PVDs at RMI, Ashtabula Site - E. Marsh, RMI Environmental Services: Once extracted from the PVDs, the soil flushing solutions will need to be treated, separated and reinjected, and/or properly disposed. The focus of this work is to identify the technologies available for separating the surfactant from the extraction wells for reinjection, and so, significantly reducing costs. Several technologies will also be tested and evaluated for treatment and disposal of the remaining residuals. This work is a joint effort between WVU, RMI Environmental, and the Ohio EPA.

## **Focus Area 2.0: Mixed Waste Characterization, Treatment and Disposal**

Analysis of Vortec Cyclone Melting System (CMS™) for Remediation of PCB Contaminated Soils - Dr. I. Celik, WVU: This project combines WVU researchers with the **Vortec Corporation**. The research focuses on providing information necessary for the design of retrofit components to an existing high temperature waste processing and recycling unit so the system can be used for remediating PCB (PolyChlorinated Biphenyls) contaminated soils via ex situ vitrification.

### **Focus Area 3.0: Decontamination and Decommissioning**

Production and Evaluation of Biosorbents and Cleaning solutions for use in Decontamination and Decommissioning - Dr. J. Kilbane, IGT: The objectives of this research are to prepare and evaluate biosorbents and cleaning solutions produced by **Institute of Gas Technology (IGT)** that may be useful in the decontamination and decommissioning of DOE facilities. The research is a collaborative project between WVU Department of Civil & Environmental Engineering and IGT that addresses the filtration/liquid processing to be used in practical applications.

Use of SpinTek Centrifugal Membrane Technology and Sorbents/Cleaning Solutions for D&D Work - Dr. B. Reed, WVU: The feasibility of using centrifugal membrane technology to separate sorbents/cleaning agents used in decontamination and decommissioning is being investigated in this work. The project uses the **SpinTek** Centrifugal Membrane to filter the sorbents/cleaning agents developed through the efforts of the **IGT** Biosorbents project.

### **Focus Area 4.0: Cross Cutting Innovative Technologies**

Use of Centrifugal Membrane Technology with Novel Membranes to Treat Hazardous/Radioactive Wastes - Dr. B. Reed, WVU: The objective of this research is to investigate the feasibility of using the **SpinTek** Centrifugal Membrane Technology coupled with innovative membranes for the treatment and/or separation of hazardous/radiological wastes. The results of this work will be a technology that can treat a variety of wastes, such as: contaminated groundwater, mixed-waste process water, waste residual, etc. The process can be used for both inorganic (radionuclides and heavy metals) and organic contaminants.

Environmental Pollution Control Devices Based on Novel Forms of Carbon - Dr. J. Zondlo, Dr. A. Brennstainer and Dr. A. Stiller, WVU: The purpose of this research is to assess the feasibility of an electrochemical system that uses high surface area carbon devices to remove heavy metals from aqueous streams. Cathodic carbon materials are being developed to maximize the conversion efficiency of the process. The system can be used to selectively remove and recover metal ions, and provides for a detailed quantitative analysis of the metal ions in solution down to the parts per billion ranges. The technology is also applicable for the removal of some radionuclides from water. Industrial tie-ins have been made with the **Carbon Materials Group at Oak Ridge National Laboratory, Applied Sciences Inc., Concurrent Technologies Corporation and Swanson Plating Co.**

Design of a Rotating Membrane Filtration System for Remediation Technologies - Dr. V. Mucino, WVU: Support is being provided by WVU's Mechanical & Aerospace Department to SpinTek Corporation for developing an optimum configuration to improve the capacity of the rotating filtration system with respect to energy consumption and cost. System optimization of the SpinTek unit requires that a relationship between performance characteristics and the systems' parameters be established. Three mechanistic models are being considered: 1) Stress Distribution Model, 2) The Dynamics Model, and 3) Fluid Dynamics Model. Various computer aided design technologies are being applied for developing these models including: the use of solid constructive geometry methods, finite element techniques and computation fluid dynamic codes.

## **Focus Area 5.0: Outreach**

Small Business Technical-Based Support - Dr. E. Cook, WVU: This project was initiated to address problems with commercialization of innovative site remediation technologies developed by small businesses funded by DOE. Once a problem or opportunity is defined, researchers from WVU, or other sources are solicited to work with the small business in a research effort to solve the problem or remove the barrier to commercialization of the process.

## **Future Activities**

Future activities will be focused on the following:

- A larger scale field demonstration at the RMI site, Ashtabula, Ohio
- Pilot scale field demonstrations of the other innovative technologies developed through the WVU Cooperative Agreement

Efforts will also be directed toward:

- Interaction and support of small businesses
- Responding to DOE's Research Announcements (ROA's & PERDA's)
- Expand research into other DOE Focus Areas
- Presentation of research at DOE and appropriate conferences

## **Contract Information**

**Cooperative Agreement Number:**  
DE-FC21-92MC29467

### **Period of Performance:**

October 1, 1992 to  
April 30, 1998

### **FETC Project Manager:**

Dr. Madhav R. Ghate  
(304) 285-4135  
Fax: (304) 285-4403

### **Contract Project Manager:**

Dr. Echol E. Cook, P.E  
Director, WVU Cooperative Agreement  
Department of Civil and Environmental  
Engineering  
P.O. Box 6103  
West Virginia University  
(304) 293-3031 Ext. 658  
Fax: (304) 293-7109  
E-mail: ecook@cemr.wvu.edu

### **Principal Investigators:**

**West Virginia University**  
**Morgantown, WV 26506**

### **Department of Civil & Environmental Engineering**

P.O. Box 6103  
Phone: (304) 293-3031  
Fax: (304) 293-7109

M. Gabr, Ext. 624  
Email: gabr@cemr.wvuedu

B. Reed, Ext. 613  
Email: reed@cemr.wvuedu

J. Quaranta, Ext. 662  
Email: quaranta@cemr.wvu.edu

### **Department of Mechanical & Aerospace Engineering**

P.O. Box 6106  
Phone: (304) 293-3111  
Fax: (304) 293-6689

I. Celik, Ext. 325  
Email: celik@cemr.wvuedu

V. Mucino, Ext. 315  
Email: mucino@cemr.wvu.edu

### **Department of Chemical Engineering**

P.O. Box 6102  
Phone: (304) 293-2111  
Fax: (304) 293-4139

J. Zondlo, Ext. 409  
Email: zondlo@cemr.wvu.edu

A. Brennsteiner, Ext. 423  
Email: abrennst@wvu.edu

A. Stiller, Ext. 408  
Email: stiller@cerm.wvu.edu

### **Department of Petroleum and Natural Gas Engineering**

P.O. Box 6070  
Fax: (304) 293-5708  
Phone: (304) 293-7682

S. Ameri, Ext. 401  
Email: ameri@cerm.wvu.edu

K. Aminian, Ext. 112  
Email: aminian@cemr.wvu.edu

### **Institute of Gas Technology (IGT)**

Dr. John Kilbane  
1700 S. Mount Prospect Rd.  
Des Plaines, IL 60018-1804  
(847) 768-0723  
Fax: (847) 768-0723  
Email: kilbane@igt.org